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BRIEFER ARTICLES

NOTE CONCERNING THE DISCOVERY OF THE NUCLEUS

Historical reviews generally refer the discovery of the nucleus to ROBERT BROWN, perhaps adding that before BROWN'S work the nucleus had occasionally been figured, but that the authors attached so little importance to the structure that usually it is not even mentioned in the text. BROWN himself cites several of these instances.

A quite forgotten paper by F. J. F. MEYEN, published in *Linnaea* (1827),[1] however, gives an account of the nucleus of *Spirogyra*, which for accuracy of observation and clearness of detailed description leaves little to be desired. A somewhat briefer account, similar in essentials, appeared a year later in a little monograph entitled *Untersuchungen über den Inhalt der Pflanzenzellen*.[2] Neither publication being commonly accessible, a paragraph from the latter is reprinted here.

Es wird hier am rechten Orte sein nochmals auf den Inhalt der Zellen, in der Gattung Spirogyra, aufmerksam zu machen. Wir beobachteten nämlich, dass mitten in den Zellen dieser Pflanze ein plattgedrücktes rundes Zellchen, durch äusserst feine verästelte Fäden an der innern Fläche der Zelle befestigt, aufgehängt ist. Es hängt dieses Organ mit den platten Flächen parallel den Grundflächen der Zelle oder des Utriculus der Spirogyra, und zeigt bei der mikroskopischen Ansicht von Oben eine längliche schmale Figur, etwa $\frac{1}{4}$ bis $\frac{1}{3}$ der Länge des Querdurchmessers der Zelle haltend. Das Organ selbst ist fast durchsichtig und ungefärbt; eine grosse Menge von äusserst feine und sich verästelnden Fasern verlaufen von verschiedenen Punkten desselben meistens büschelförmig nach der innern Fläche des Utriculus, woselbst sie sich abermals ansetzen, um jenes Organ, gleichsam wie eine Spinne in ihrem Gewebe, in der Mitte des Utriculus fest zu halten. Es schien mir, als wären es stets 4–6 dergleichen Büschelchen feiner Fasern, die sämmtlich, nach verschiedenen Seiten verlaufend, das Zellchen in der Mitte des Schlauchs befestigen. Die Fasern selbst sind wohl die feinsten, die bis jetzt im ganzen Pflanzenreich beobachtet worden sind, sie sind ungefärbt, durchsichtig und daher sehr leicht zu übersehn. Ihrer grossen Feinheit wegen vermag man bei einer 300 maligen Vergrösserung an ihnen nichts mehr zu beobachten, als

[1] Ueber das Genus *Spirogyra* Lk., und über die Bewegung und Metamorphose der *Sp. princeps* insbesondere. Linnaea **2**:428. 1827.

[2] Berlin, 1828, p. 55.

ihre Verästelung nach der Schlauchmembran zu. Die über dieses Organ gemachten Beobachtungen sind folgende: Durch Einwirkung von Weingeist und kochendem Wasser wird das längliche Organ ganz kugelrund. Auch wird es kugelrund, wenn die Pflanze ihren individuellen Lebenslauf vollendet hat und sich aufzulösen anschickt, alsdann reissen die Fasern allmälich sämmtlich entzwei, und das Organ selbst fällt aus der Mitte zur Seite, und nach Eröffnung der Zelle, durch Fäulniss, tritt es selbst zur Zelle hinaus. Zu dieser Zeit erscheint in jeder kugelförmigen Zelle, wozu sich jenes längliche Organ umgewandelt hat, ein längliches Infusorium, dessen Gestalt wir bei der schon angeführten Abhandlung abgebildet haben. Nach Ausbildung des Infusoriums öffnet sich nämlich die kugelförmige Zelle, und das neue Thier tritt heraus.

Figures supporting the description accompany the paper in *Linnaea*. The earlier paper distinguishes more sharply than the quoted paragraph between observation and interpretation when it comes to the metamorphosis of the organ in question into an infusorium, the author concluding his observations with "So weit meine Beobachtungen," and then proceeds to show that probably the infusoria found about decaying *Spirogyra* originate in the organ described. In view of the prevalence at the time of the doctrine that infusoria take origin in a metamorphosis of decaying plant parts, the attempt to find a connection between the newly discovered organ and the formation of infusoria does not detract from the value of MEYEN'S contribution. Nor is the fact that he speaks of the organ as a "cell" of significance, the term being freely used at the time to designate in a general way any globular or vesicular structure, as well as in the more restricted sense.

It is a curious fact that this work of MEYEN'S has dropped so completely out of the current of citation. In 1830 he reprinted the account, unchanged in essentials, in his *Phytotomie*, under the heading "Thierbildung im Zellensaft."[3] In the section of his *Physiology* discussing the nucleus,[4] he does not refer to this work, but later on[5] he devotes several pages to it. He has become skeptical whether this organ gives rise to infusoria, but, notwithstanding considerable further study, he was unable to come to a conclusion regarding its nature. SCHLEIDEN had just attracted increased attention to BROWN'S work on the nucleus by the important rôle he ascribed to it in his *Phytogenesis*. MEYEN, attacking his rival's theory, used as one of his arguments that the nucleus is lacking in many tissues. Consistent with this line of thought, mini-

[3] Phytotomie, Berlin, 1830, p. 165.

[4] Neues System der Pflanzen Physiologie **1**:207. 1837.

[5] *Op. cit.* **3**:418. 1839.

mizing the importance of the nucleus, he questions whether the organ he described in *Spirogyra* is BROWN's nucleus.[6]

SCHLEIDEN, intentionally or otherwise, does not mention this work of MEYEN in his *Phytogenesis* nor in the *Grundzüge;* he names BROWN the discoverer of the nucleus, and this statement in these widely circulated publications is to a great extent the source of the current opinion that BROWN gave the first description of the nucleus.—W. MARQUETTE, *University of Wisconsin, Madison, Wis.*

NUCLEAR PHENOMENA IN PUCCINIA PODOPHYLLI

(PRELIMINARY NOTE)

In the mycelium of *Puccinia Podophylli* which is to give rise to aecidia and spermagonia a binucleate condition prevails, the nuclei being associated in pairs and dividing conjugately throughout all parts of the mycelium, even before there is any indication of aecidium formation. This condition, however, is not constant. Uninucleate cells are occasionally observed, while those with more than two nuclei are very common.

The aecidium arises in a dense tangle of hyphae beneath the epidermis of the host. Certain cells in the midst of this tangle enlarge and become the "basal cells" of the aecidiospore chains. Whether any one of these cells is simply the enlarged termination of a hypha or is the product of the fusion of two cells, as originally described by CHRISTMAN for certain aecidia of the caeoma type, is not clear. Appearances have been observed which seem to indicate that such a fusion may occur, but any final conclusion upon this point is at present unwarranted. No migrations of nuclei between cells of the same or different hyphae can be recorded. The young basal cells contain two, three, or four nuclei, which at this stage become very large. The very frequent occurrence of four-nucleate basal cells upon a prevailingly binucleate mycelium is a further indication that such cells may not be of simple origin.

The aecidiospores, which are formed with intercalary cells in the usual manner, contain two, three, or four nuclei, depending upon the number contained in the basal cells from which they are derived. In older chains only two of the basal cell nuclei continue to function in this capacity, so that the binucleate spores finally far outnumber the others.

[6] It is to be noted that vol. I of the Neues System der Pflanzen Physiologie was published a year earlier than SCHLEIDEN's Phytogenesis.